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each containing sixty-four pages).——Valuable exsiccati now publishing are: Ellis & Everhart's "North American Fungi"; Linhart's "Ungarus Pilze"; "Der Belgischen Muscineen," by Aigret and François; Wittrock and Nordstedt's "Algæ Aquæ Dulcis Exsiccatæ"; Krieger's "Fungi Saxonici Exsiccati"; Winter's "Fungi Europæi et Extraeuropæi Exsiccati."——Recent catalogues of botanical works which will prove valuable to botanical book-buyers are as follows: "A Catalogue of Botanical Works," by Dulan & Co., 37 Soho Square, London; "Bulletin Trimestriel des Sciences Naturelles" of Paul Klincksieck, 15 Rue de Sèores, Paris; "Katalog No. 202," von Heinrich Lesser, of Breslau; "Verzeidenis von Werken aus dem Gesamtgebeite des Botanik," von List & Frank, Leipzig; Koehler's "Katalog No. 448" (Floræ, Anatomia et Physiologia Plantarum, Phanerogamæ, etc.) and No. 449 (Cryptogamæ), Leipzig.

ENTOMOLOGY.[1]

On the Emergence of a Caddice-Fly from the Water.—On one occasion I had the good fortune to observe a caddice-fly leave the water and take its first flight. The specimen was an *Hydropsyche*, which I was breeding in an aquarium in my laboratory. It swam to the surface of the water repeatedly, using its long mesothoracic legs. When swimming, these legs were extended at right angles to the body like a pair of oars. The insect was unable to crawl up the vertical side of the aquarium, and after clinging to it for a short time it would lose its hold and sink back to the bottom. After watching it for a time I lifted it from the water by means of a stick. At this time its wings were in the form of pads, which were but little, if any, longer than the wing-pads of the pupa, as shown by the cast pupa-skin found floating on the water. The instant the creature was free from the water its wings expanded to their full size, and immediately it flew away several feet. In my efforts to catch the insect I found that it had perfect use of its wings, although they were so recently expanded. The time required for the insect to expand its wings and take its first flight was scarcely more than one second; it was certainly less than two. As these insects normally emerge from rapidly-flowing streams which dash over rocks, it is evident that if much time were required for the wings to become fit for use, as is the case with most other insects, the wave succeeding that which swept them from the water would sweep them back again and destroy them.—*J. H. Comstock.*

Destruction of the Codlin-Moth by Arsenical Poisons.—In the first of a series of bulletins to be published by the State entomologist of Illinois Professor Forbes gives the results of a series of experiments made by him to test the efficiency of arsenical poisons in the protection of apples from the codlin-moth. From observations and experiments which he details, he estimates that about fifty per cent. of the possible apple crop is sacrificed to this insect. As the value of the apple crop of Illinois for the five years preceding 1884 is shown by the assessors' reports to have been about four and three-quarter million dollars, the value of the apples destroyed in an average year may be placed at this sum. A part of the apple crop reported, however, is doubtless obtained from neglected orchards, too badly damaged to repay especial attention; and in many cases, also, where the trees are heavily laden, the apples remaining uninjured after the codlin-moth has done its worst may amount to more than half the fullest crop permissible. Making for these and other modifying circumstances the liberal allowance of fifty per cent., Forbes estimates the loss due to the apple-worm in Illinois at one-half the value of the average crop, or two million three hundred and seventy-five thousand dollars. He then goes on to show that at least seven-tenths of this loss may be prevented by a single remedial measure so simple that any one may apply it, and without cost so far as its effect on the codlin-moth is concerned.

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[1] This department is edited by Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

The insecticide employed was Paris green in water sprayed upon the trees with a force-pump. Three-fourths of an ounce by weight of Paris green, of a strength to contain 15.4 per cent. of metallic arsenic, was stirred up in two and a half gallons of water. White arsenic was also used, but was found not to be as efficient as Paris green; and the leaves on the trees which were sprayed with arsenic were scorched, while those to which Paris green was applied were entirely uninjured.

The time of year at which poisoning is most effective is in the spring, after the apples have begun to form, and while they are still upright. The poison lodges in the calyx, where, as is well known, the egg of the codlin-moth is laid. The young larva is thus poisoned as soon as it begins to eat its way into the apple. Later in the season, after the apples have begun to hang downwards, spraying will not deposit the poison where it will be reached by this insect. Moreover, it is dangerous to apply the poison late in the season, as it will lodge in the cavity about the stem of the apple, a position from which heavy wind and violent rain are not sufficient to remove it.

The results of his experiments are given by Forbes with considerable detail. They show that by spraying once or twice with Paris green in early spring, before the young apples had dropped upon their stems, about seventy-five per cent. of the apples exposed to injury by the codlin-moth were saved. The incidental benefit to the crop in the protection of the trees against foliage-eating insects, and also against the Apple Curculio, by thus spraying will fully compensate for the small expense of the Paris-green application. This expense, when the spraying is done on a large scale, with suitable apparatus, only once or twice a year must fall below an average of ten cents a tree.

On the Life-History of a Dipterous Parasite of the Silkworm.—In the new journal published by the Imperial University, Japan,[1] Professor Sasaki gives a very important paper on a dipterous parasite of the silkworm. Aside from the economic bearing of the paper, it is of interest to entomologists generally as giving a careful account of the habits of a parasitic insect which is peculiar in its mode of attack.

The so-called "Uji" disease, caused by the larva of a dipterous insect, *Ugimya sericaria*, plays terrible havoc among the silkworms reared in May and July. When the silkworm is once infested by this parasite it dies either before or after it spins a cocoon; in the latter case the maggot eats its way out of the cocoon, thus leaving a round hole in it, with the consequence of making it unfit for reeling. In the spring or May brood of silkworms some fifty to seventy per cent., or in extreme cases eighty per cent., are attacked by the parasite, and the damage done is correspondingly great.

Fatal as the "Uji" disease is to the silkworm, no systematic observations have hitherto been made on the habits and life-history of the maggot; but in this paper the insect is described in each of its stages, and considerable attention is given to anatomical features. We will notice, however, only that part which relates to the habits of the insect.

The adult flies generally begin to appear in April. From this time to the middle of June they frequent mulberry-bushes. The eggs are laid on the under surface of the leaves, in close contact with the ramified veins. The eggs are fastened to the leaves and enveloped with a transparent glutinous substance. Usually the eggs laid upon leaves in the month of May, if undisturbed, will remain alive during the month of June, but later they are destroyed by the severe heat of the sun. At the time when the deposition of the eggs takes place most abundantly the silkworm is in its third or fourth moult. The eggs are taken into the body of the silkworm at this time with its food. The small size of the egg and the hardness of the shell protect it from injury by the jaws of the insect.

In one to nine hours after the eggs are introduced into the digestive canal of the silkworm they hatch. The young larva measures 0.3 and 0.2 millimetre in length and breadth respectively. Its smaller anterior end is provided with a horny-hooked

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[1] Journal of the College of Science, Imperial University, Japan, vol. i., Part I. Tokio, Japan, 1886.

jaw, while its broader posterior end has two spiracles, and each segment of the body is covered with a transverse row of setæ.

After remaining in the digestive canal from one to eight hours the larvæ pass out through the wall of the canal, and enter directly into the ganglia which lie close beneath the canal, generally leaving those ganglia free which are separated from the canal by the interposition of the silk-glands.

A single silkworm has usually one or two of its ganglia infested by the maggots, but sometimes more are found. In one case Sasaki found five ganglia thus infested by the parasite. Furthermore, a single ganglion may have more than one parasite in its interior. Nevertheless, usually but one reaches maturity. When the maggots once infest the ganglia the silkworm becomes generally weakened, and its body presents an unusual aspect from severe irritation of the nervous system. The segments are swollen out like the caterpillars of some hawk moths, and the disease is usually known by the silkworm-growers as *Fushidaka* or *Fushiko*,—swelled segment. Generally the maggot remains in a ganglion more than a week, and when it has become two to five millimetres long, or even larger in size, it gets free and passes into the body cavity of the silkworm. After travelling through the mass of fat which occupies the greater portion of this cavity it searches for the portions of the tracheal system of its host, where the stigmata open. On reaching one of these places it forces its way into the chamber directly inside the stigma, and forms a sort of a cup for the reception of its body by heaping up the fats and muscular fibres of its host round the opening made on entering, and sticking them together with its saliva. The mouth of this cup is directed towards the body cavity, while its bottom opens into the stigma of its host. The maggot, which rests in the newly-formed cup, projects its anterior end into the body cavity from the mouth of the cup, while its posterior end is directed towards the bottom of it. In this position the maggot anteriorly consumes fat as its food, and posteriorly respires the air which enters through the stigma. The cup which the maggot thus inhabits has a dark-brown color, partly produced by the action of the saliva upon the fats and muscles which build up the cup, and partially by the fæces which the maggot voids. When the cup thus colored is formed inside a stigma there appears a dark-brown or brownish-black patch around the stigma; so the presence of the patch is conclusive evidence of the fact that the silkworm is infested by its parasite. The similar marking which occurs on the body of a pupa enclosed in a cocoon is always due to the same cause. As the maggot grows in size the cup enlarges in proportion, and the maggot remains in this abode until it attains its full maturity, no matter whether the silkworm meanwhile turns into a pupa or not. The maggot usually leaves the cocoon of its host in the morning, especially of bright and hot days. Before changing to a pupa it usually crawls into the ground, getting down through some cracks or fissures in the floor of the house where it comes out. It descends to a depth of three or four inches before transforming. There is but a single generation in a year.

Entomological News.—The vine-growers of Algeria are now seriously troubled by the destruction caused by a Chrysomelid beetle, *Haltica ampelophaga.* In some places more than a third part of the whole production is destroyed by it. It feeds on grape-vine leaves only, eating them as fast as they appear, and ultimately killing the vine. As it is a very prolific insect, passing through at least five generations in a single summer, much is to be feared from it (*Science*, April 1).——Mr. George D. Hulst doubts the conclusion of Riley, that the dehiscent species of Yucca are fertilized only by the agency of *Pronuba yuccasella.* Mr. Hulst saw many honey-bees within the flowers before they closed in the forenoon, and only a small proportion of the capsules examined afterwards contained larvæ of Pronuba (*Entomologica Americana*, vol. ii. No. 12).——Miss Ormerod's "Tenth Report of Observations of Injurious Insects" has just appeared.

ZOOLOGY.

Artificial Parthenogenesis.—Two cases of parthenogenesis induced by artificial stimuli are of interest. The first is that recorded by Tichomiroff (*Archiv f. Anat. und Phys.*, 1886; *Phys. Abth. Suppl. Bd.*). He found, in the course of investigations instituted for another purpose, that the unfertilized eggs of the silkworm, under the influence of mechanical or chemical (strong sulphuric acid) stimuli, will develop. He concludes his short account with the following words: 1. "There can be no doubt that the eggs of *Bombyx mori* are capable of parthenogenetic development;" and, 2. "Such eggs which would not otherwise parthenogenetically develop may be induced to do so by stimuli." More interesting are the observations of Dr. J. Dewitz (*Biol. Centralblatt*, vii. p. 93). Normal parthenogenesis has been well authenticated in the case of the silkworms, but not in the Amphibia. Dr. Dewitz, with another purpose in view, placed some unfertilized frogs' eggs in a solution of corrosive sublimate, and, to his great astonishment, the next morning found them swollen and segmented. Some showed but one division, while others had divided several times. A few were irregular in their segmentation, but in the majority the normal order was followed. These facts were observed on the eggs of *Rana fusca*, *R. esculenta*, and *Hyla arborea*, and it was noticed that but a short immersion in the sublimate solution was sufficient to induce the segmentation.